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The Effect of Financial Liberalization on the Allocation of Credit

Panel Data Evidence for Ecuador

Fidel Jaramillo
Fabio Schiantarelli
and
Andrew Weiss

The evidence suggests that liberalization resulted in a reallocation of resources toward older, larger, and more efficient firms.

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Jaramillo, Schiantarelli, and Weiss discuss two effects of financial liberalizaton, using panel data for Ecuadorian firms.

After describing the main thrust of the reforms and the general macroeconomic developments, they document the changes that occurred in firms' financial structure and in the allocation of credit.

Descriptive evidence suggests that there has been a reallocation of resources toward older, larger firms after liberalization. The authors also investigate econometrically whether financial reform has helped direct credit to more efficient firms. The results, based on measures of technical efficiency obtained from estimating stochastic production frontiers, show that this has indeed been the case in Ecuador.

THE EFFECT OF FINANCIAL LIBERALIZATION ON THE ALLOCATION OF CREDIT: PANEL DATA EVIDENCE FOR ECUADOR

by

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ABSTRACT

In this paper we discuss the effect of financial liberalization, using panel data for Ecuadorian firms. After describing the main thrust of the reforms and the general macroeconomic developments, we document the changes that have occurred in firms' financial structure and in the allocation of credit. The evidence suggests that there has been a reallocation of resources toward larger and older firms after liberalization. We also investigate econometrically whether financial reform has helped in directing credit to more efficient firms. Our results, based on measures of technical efficiency obtained from estimating stochastic production frontiers, show that indeed this has been the case in Ecuador.

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THE EFFECT OF FINANCIAL LIBERALIZATION ON THE ALLOCATION OF CREDIT: PANEL DATA EVIDENCE FOR ECUADOR

I.- INTRODUCTION

It has been forcefully argued that heavily regulated financial systems--which are characterized by very low interest rates, government interference in the distribution of credit, and preferential treatment for priority sectors--have serious drawbacks.[1] For example, a ceiling on interest rates may discourage savings. Implicit or explicit subsidies and administrative controls on the allocation of credit may not provide financial intermediaries with the right incentives to screen and monitor borrowers. Moreover, it is possible that larger and politically better connected borrowers benefit the most from directed credit programs. Finally, subsidized interest rates may encourage investment projects with low yields and may favor the adoption of highly capital-intensive production techniques. Conversely, the elimination or reduction of government interference with credit flows is thought to improve the efficiency of resource allocation by financial intermediaries, with beneficial effects on the economy's growth rate.

Evidence from firm panel from countries that have introduced financial reforms can shed light on some of these issues. In this paper we present an overview of the effect of financial liberalization on firms' performance and behavior in Ecuador, and we discuss how the impact of reform varies according to firms' size, age, and market orientation. The main issue we address is the effect of policy changes on credit allocation. More specifically, we investigate econometrically whether liberalization has helped in directing credit to more efficient firms. We base our empirical work on a panel data set that contains balance-sheet and profit and loss statements from a large number of manufacturing companies over the period 1983-1988. In a companion paper (Jaramillo, Schiantarelli, and Weiss (1992)) we discuss whether the importance of financial constraints in firms' investment decisions varies across firms and whether liberalization relaxed these constraints.

The structure of this paper is as follows. Section II gives an overview of the macroeconomic developments in Ecuador during the 1980s and describes the main policy changes that have occurred during this decade, with particular attention to the

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[1]See McKinnon (1973) and Shaw (1973). See also Fry (1988) for a critical review.

process of financial liberalization. Section III, using panel data for several hundred companies, describes and interprets the evolution of firms' investment activity, profitability, and financial structure. Section IV discusses the change in the allocation of debt before and after liberalization. We use our panel to recover firms' specific measures of technical efficiency and to present econometric evidence on the association between efficiency and debt distribution. In the conclusion we summarize our results.

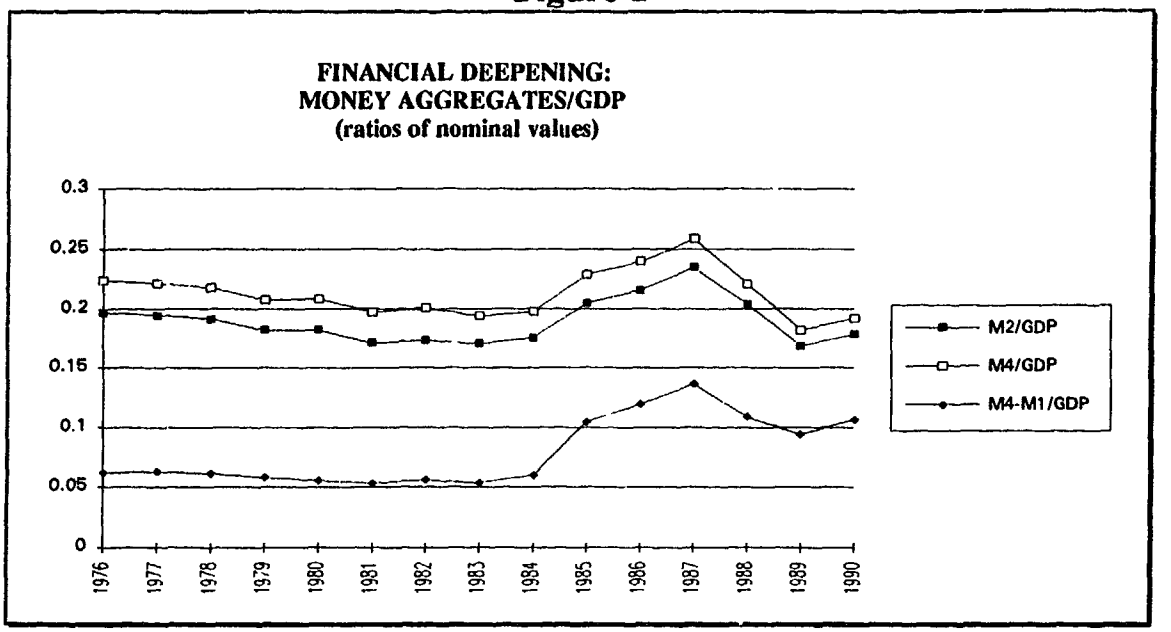
II. MACROECONOMIC OVERVIEW AND POLICY CHANGES

The economic prosperity Ecuador enjoyed during the 1970s changed dramatically in 1982, when a set of adverse shocks hit the economy. The drop in oil prices (oil is the main Ecuadorian export), higher international interest rates, and shrinking external financing caused a severe balance of payments disequilibrium, with the current account deficit reaching 11 percent of GDP. In 1982 Ecuador initiated a program of economic adjustment, as a precondition to obtain funding from international agencies. In May, the country signed the first Stabilization Program with the IMF that included devaluation, an increase in nominal interest rates, and a rise in the prices of fuel and public services.

In the second quarter of 1983, Ecuador signed a second and stricter Stabilization Program with the IMF. Besides further devaluation and a reduction of public subsidies, the government introduced a crawling peg regime for the exchange rate and approved an Emergency Law that froze government expenditures. Nominal interest rates were increased and some special subsidized rates were eliminated. Interest rate dispersion was reduced, but not eliminated.

The strategy of economic liberalization was confirmed and expanded in 1984: interest rate controls were partially lifted. The market was allowed to determine rates for certificates of deposits called "polizas de acumulacion". In August of 1986, interest rates on deposits and loans made with resources mobilized by the financial institutions were freed, and the real rate reached positive levels. Subsidized credit lines for special activities were eliminated or significantly reduced. At the same time, the exchange rate was allowed to float; import controls, subsidies and tariffs were reduced (although the latter remained quite high for manufacturing); and some price controls were eliminated.

Figure 1



Source: Banco Central del Ecuador (1988), Boletin Anuario #11, p. 19-47; Banco Central del Ecuador (1991), Información Estadística #1659, p. 15-21. M2 = M1 + time and savings deposits; M1=money in circulation plus demand deposits; M4 = M2 + all the financial liabilities of the financial system to the private sector. The difference between M4 and M1 represents the savings captured by the financial system (financial savings). Ref.: D:\THESIS\EXFILE\MONGRAF1.DOC

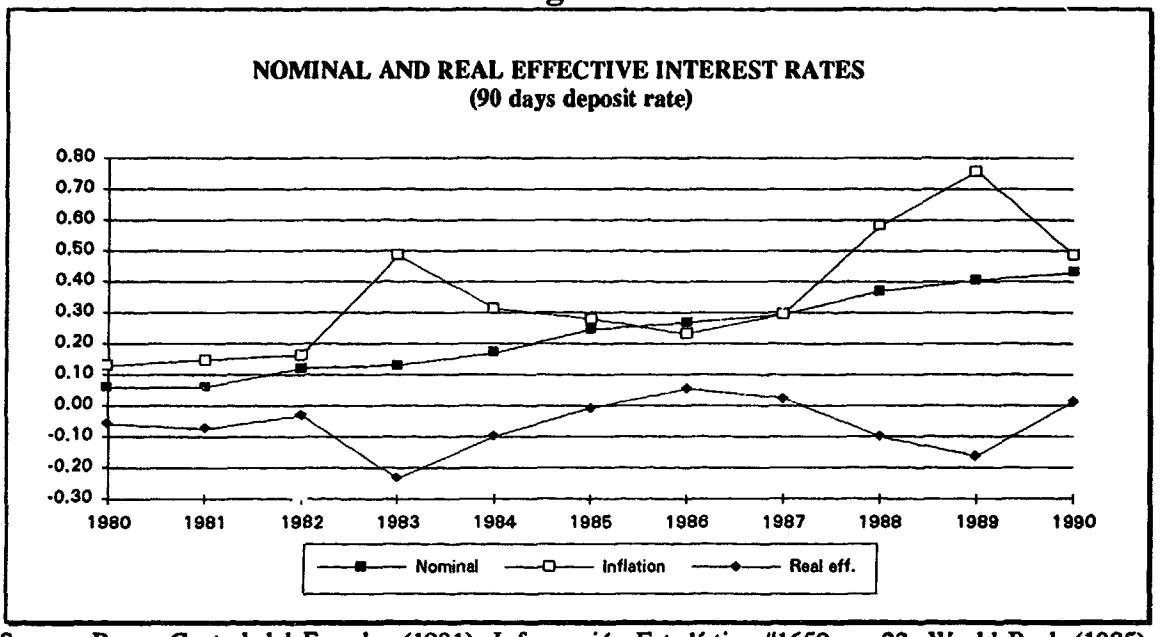
Prior to the financial reform, Ecuador had unusually low financial depth (M2/GDP, M4/GDP, (M4-M2)/GDP). For instance, in an inter-country study, Ecuador had the lowest level of M2 relative to GDP except for Peru, a country with huge inflation and a lower level of per capita income (World Bank, 1985). Figure 1 shows the decline of different monetary aggregates relative to GDP from 1976 to 1983.

The interest rate policy followed during the 1970s and early 1980s was one of the most important reasons for this poor record in financial resources mobilization. Until 1981, interest rates were fixed at levels far below the inflation rate. In 1981, for example, the inflation rate was 13.4 percent, while the deposit rate for savings was 6 percent. As a result of negative interest rates (see Figure 2), financial savings were discouraged, and foreign financial assets and domestic inflation hedges (real estate, for example) were more desirable than deposits with the banking system.

The macroeconomic policy changes of 1983, together with the beginning of financial liberalization in 1984, led to a nominal interest rate closer to the inflation rate, but still below it. With the introduction of the "polizas de acumulacion" at market determined rates, real rates on deposits became positive in 1986 for the first time in two decades, as we can see in Figure 2. The higher return on these new certificates of

deposit made them one of the most popular financial instruments, and they expanded rapidly. As a result, the financial system was better able to mobilize resources, and financial deepening improved. Figure 1 shows how the ratio M2/GDP increased from around 17 percent to 23 percent, mainly due to the increase of the "polizas de acumulacion". Moreover, it is interesting to note that financial savings (i.e. M4-M1) increased even faster, from around 6 percent of GDP to 13 percent, as a result of a movement away from narrowly defined money into the more attractive financial instruments. The real rate reduction that occurred in 1988 and 1989 and the successive increase in 1990 will be discussed below.

Figure 2



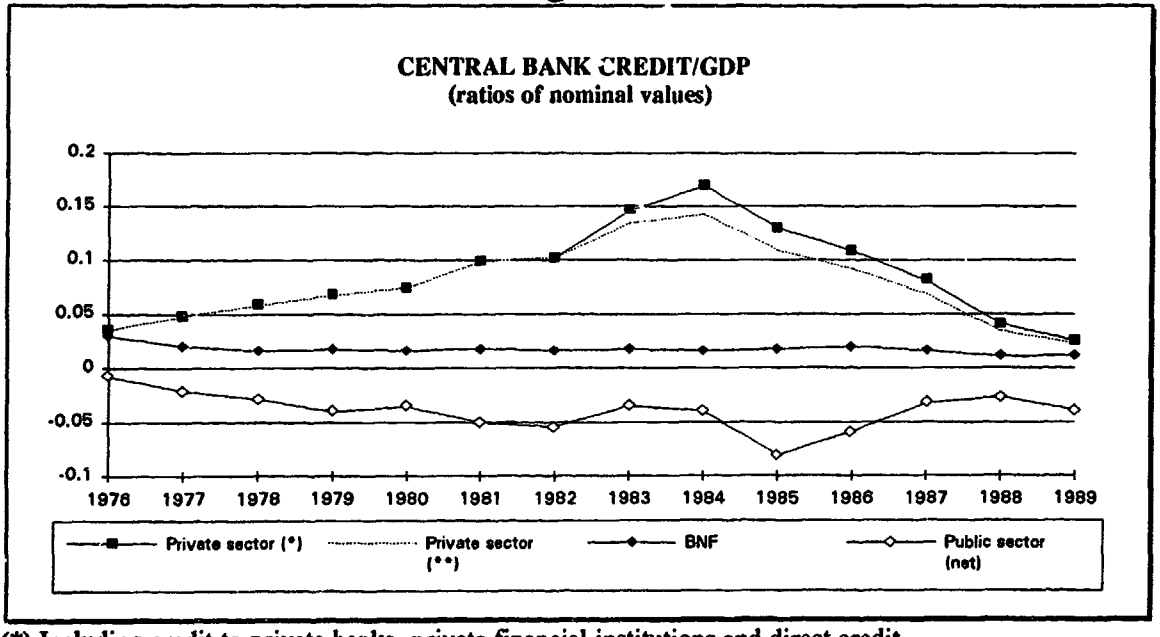
Source: Banco Central del Ecuador (1991), Información Estadística #1659, p. 23. World Bank (1985), Annex Table 2.8. See footnote for definition of interest rates.[2]

[2]The real effective rate (r) for a 90 days nominal deposit rate (i) was calculated as $r = \frac{(1 + i/4)^4}{1 + \pi} - 1$, where π is the average annual inflation rate.

The development of the financial sector in Ecuador is closely related to Central Bank credit policies. The Central Bank granted credit to the public sector, to public financial institutions (mainly the Banco Nacional de Fomento (BNF)), to private financial institutions, and directly to the private sector. A large percentage of lending in the financial system was through special, subsidized credit lines for projects in particular sectors, including agriculture, livestock, small industry, handicraft, and tourism. These lines were financied through forced investments by the banks (Financial Funds) and subsidized, Central Bank rediscounts.

The role of the Central Bank as a source of loanable funds for private banks and financial companies increased steadily during the 1970s and early 1980s. Figure 3 shows how the outstanding credit of the Central Bank as a percentage of GDP increased from less than 5 percent in the mid seventies to around 15 percent in 1984.

Figure 3



(*) Including credit to private banks, private financial institutions and direct credit.
(**) Excluding stabilization credit . See footnote (5) below for explanation.
Source: Banco Central del Ecuador (1988), Boletin Anuario #11, p. 19-47; Banco Central del Ecuador (1989-1990), Boletin Anuario #12, p. 12-30.

In other words, given the policy of low interest rates, the financial system had become increasingly dependent on the Central Bank lines of credit. Private banks and financial institutions were acting as recyclers of cheap Central Bank credit. In addition, low preferential lending rates provided firms that had access to credit with an incentive to choose a highly leveraged capital structure. Firms excluded from the

system faced high borrowing costs in the parallel or foreign markets, or an outright inability to raise external finance.

It is true, therefore, that prior to reform the financial system was "repressed" in the sense that administrative controls over interest rates and credit allocation limited its efficiency in intermediation and allocation of resources. Nevertheless, before liberalization, Ecuador private sector enjoyed a period of rapid growth in total credit. The flow of credit to the private sector expanded at an average annual rate of 12.2 percent in the 1973-1981 period, and at 8.2 percent in the 1982-1985 period. However, the main reason for this credit expansion was the rapid growth of Central Bank direct and indirect lines of subsidized credit to the private sector, as we saw in Figure 3.[3]

Certainly financial reform and interest rate liberalization improved the ability of the system to capture financial savings. Simultaneously though, reforms included a drastic contraction of most of the directed credit from the Central Bank. After 1984, Central Bank credit to the private sector was reduced from 17 percent to less than 4 percent of GDP. Obviously, this contraction meant a severe reduction of credit availability to the private sector. The flow of new debt (in real terms) decreased at an average annual rate of 6.8 percent between 1986 and 1989, largely because the Central Bank contracted the credit granted to financial institutions. Such contraction overshadows any increase that may have occurred in the amount of savings intermediated by financial institutions because of rising real interest rates in the mid 1980s.

In the second half of the 1980s, Ecuador was again subject to a series of adverse shocks. The oil price collapse at the end of 1986, and a major earthquake in 1987, caused a decline in GDP of 6 percent. This decline, together with fiscal

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[3]Besides domestic credit, the private sector had access to foreign loans. Until the early 1980s, domestic borrowers found borrowing from abroad attractive since interest rates were lower in the world markets, and Ecuador had had a fixed exchange rate of 25 sucres per dollar for more than a decade. Private foreign debt increased from $12 million in 1972 to $1.6 billion in 1982. In many cases, these loans were guaranteed by Ecuadorian commercial banks as off-balance sheet items. The borrowing stopped abruptly in 1982 when the Mexican debt crisis sharply reduced new lending and the Ecuadorian Government devalued from 25 to 33 sucres per dollar in 1982, and to 42 in 1983, starting thereafter a crawling peg system. Devaluation, together with higher international interest rates, dramatically increased the cost of servicing private foreign debt in terms of domestic currency and put many firms into bankruptcy. Ecuador began a program of relief for private foreign debt, a debt swap in which the Central Bank accepted private debtors liabilities to foreign creditors and became a creditor to those debtors by issuing "sucretized, stabilization credits". The conversion of debts from dollars to sucres was done on favarable terms for the debtor. For details of this program see Younger (1990), Uquillas (1991).

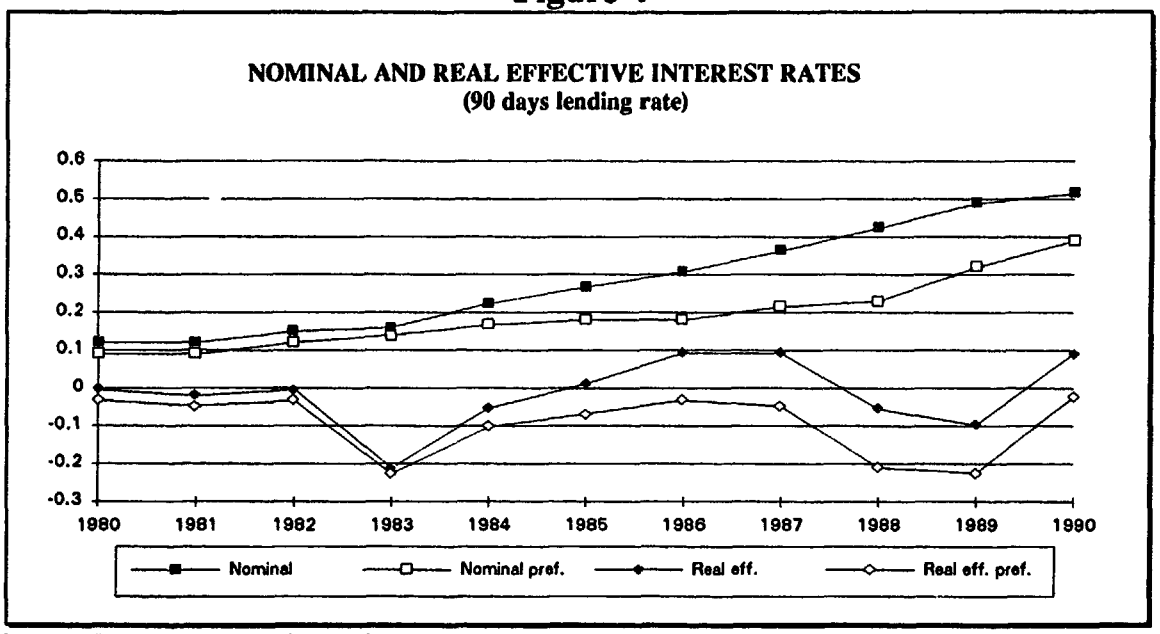
mismanagement, caused the worst inflation in Ecuadorian history. Prices increased at an average of 58 percent and 76 percent in 1988 and 1989. Some limits were imposed on loan interest rates (specifically, the spread was limited over the saving deposit rate), real interest rates became negative, financial deepening was again discouraged, and total credit to the private sector fell even faster. A new stabilization plan was introduced. Beginning in 1989, the authorities tried to cut inflationary pressures by reducing Central Bank credit to the public sector, as well as by reducing the fiscal deficit. Average inflation rate in 1990 dropped to 48.5 percent and stabilized thereafter at close to 50 percent. After the abnormal inflation of 1988 and 1989, nominal interest rates began to catch up with prices. Real lending rates turned positive again in 1990, as limits on the spread were eased. Similarly, the M2/GDP ratio (and the other measures of financial deepening) stopped declining and began to rise again after 1989, as Figure 1 shows. It is interesting to note that even though interest rates were largely market determined, real rates were highly negative in 1988 and 1989. Different explanations have been suggested. The unusually high level of inflation might have been unanticipated or seen as temporary. Since agents expected a future drop in the inflation rate (as in 1983-1984, after the floods), nominal rates did not increase as fast as actual inflation did. There are other possible reasons for the lagging of nominal rates behind inflation. It is possible that banks did not want to raise nominal interest rates drastically, since the increase of debt service could have put many firms into bankruptcy. With widespread bankruptcies, the financial stability of the banks themselves could have been jeopardized, as occurred in Argentina and Uruguay (see Tybout, 1986).

What effects did the changes in macro and financial policies during the 1980s have on the cost of external finance? In the mid eighties, the decrease of Central Bank credit to financial institutions and the liberalization of interest rates had a severe impact on companies. Firms, in particular those over leveraged after a decade of easy credit, faced two shocks: their cheap sources of credit were drying up, and the cost of servicing the outstanding debt was increasing. The real effective lending rate, after years of being negative or close to zero, reached 10 percent in 1986 and 1987. Even the interest on preferential credit from the Central Bank increased, although it was still negative in real terms, as we can see in Figure 4.[4] More important, the availability of

[4]There are several subsidized lines of credit from the Central Bank, each with its own conditions and interest rate. For the purpose of illustration we present an average of the lending rate of banks and financial institutions using resources from the Central Bank under one of the most popular programs, preferential rediscounts.

preferential credit decreased substantially over the years. Real non-preferential lending rates became negative in 1988 and 1989 and returned to positive levels in 1990.

Figure 4



Source: Banco Central del Ecuador (1991), Información Estadística #1659, p. 13. World Bank (1985), Table 2.8.

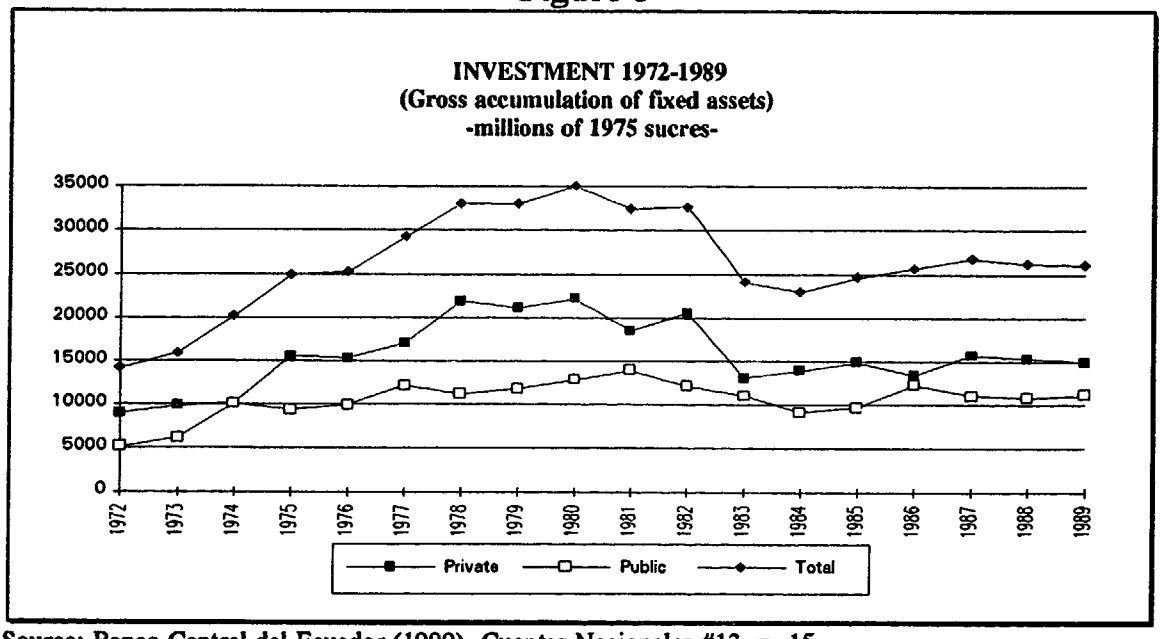
What was the behavior of aggregate investment during this period of structural change? The 1970s had been years of high investment growth rates that paralleled the general expansion of the economy (see Figure 5). Cheap credit and the fixed exchange rate policy partly explain this robust investment performance. In 1980-1982, investment expenditure remained high, but following the 1982-1984 crisis, private investment decreased by an average of 6.6 percent (with a peak decrease equal to 36.2 percent in 1983).[5] Investment performance is also closely related to the availability and cost of foreign exchange, because a significant proportion of capital goods are imported. In the early eighties, before the crisis, the share of imported investment goods out of total investment was as high as 47 percent.[6] Between 1970 and 1982, Ecuador kept the nominal exchange rate fixed. Inflation, though moderate during the 1970s, caused a continuous real appreciation of the domestic currency; this tendency favored imports. With the crisis and the introduction of import controls,

[5]Estimated private investment includes investment by some firms that have substantial public ownership.

[6]Imported investment refers to gross accumulation of imported fixed assets. Domestic investment refers to gross accumulation of domestic fixed assets.

foreign exchange availability decreased, while the devaluation that followed made imports more expensive. As we have just seen, investment expenditures decreased, in particular purchases of imported capital goods, whose share of total investment fell to an average of 34 percent. Investment activity showed some improvement during the 1985-1989 period, when investment increased at a yearly average of 1.8 percent. We will discuss the behavior of investment in more detail in the next section.

Figure 5



Source: Banco Central del Ecuador (1990), Cuentas Nacionales #13, p. 15

III. FINANCIAL REFORM AND FIRMS' BEHAVIOR IN THE 1980s: DESCRIPTIVE EVIDENCE FROM COMPANY DATA

We have seen that financial liberalization in Ecuador is an incremental process that starts in 1983-84, when interest rate controls are partly lifted. A marked acceleration takes place in 1986 with the elimination of most interest rate controls and a further reduction in the role of directed credit programs. In order to evaluate the micro effect of financial reform, we rely on a large panel of 853 Ecuadorian manufacturing companies during the 1983-1988 period. For 420 companies the data are available for the entire period. The data have been collected by the Superintendencia de Companias of Ecuador and consist of balance sheets and profit and loss accounts (Appendix A contains a fuller description of the data). The information allows us to assess how financial liberalization affected financial and real decisions and how such an effect varied across different categories of firms, in other words, small or large, exporting or nonexporting, young or old. Given the nature of policy changes in Ecuador, ideally one would want to have information covering a longer time period before and after liberalization. Unfortunately data are not available before 1983, and not yet accessible for the post 1988 period. However, much can be learned if we split our sample of firms in 1986, since 1986 represents a turning point in the reform process.

We start by describing the trends in firms' profitability, investment, and capital intensity. We then investigate the changes in companies' financial structures. We conclude this section by presenting descriptive evidence on how liberalization affects the allocation of credit.

III.1. PROFITABILITY, INVESTMENT, AND CAPITAL INTENSITY

During the period 1984-1988, the manufacturing sector had to cope with several policy changes. Financial liberalization was introduced, and tariff protection and exchange rate controls were somewhat relaxed. Moreover, during the early 1980s the balance of payments crisis required a severe macro adjustment. At an overall level, the readjustment process did not greatly affect the profitability of the firms in our sample (see Table 1). However, the evolution of profits was not homogeneous across different categories of firms. If we divide our sample according to the size of the capital stock in the initial year, both indicators of profitability (operating profits relative to capital, S/K, and after tax net profits relative to capital, P/K) suggest that the adjustment process was particularly severe for small firms that produced mainly for the

domestic market and benefited from subsidies and protection.[7] Micro companies also saw their profits decrease substantially.[8] Medium and large firms did better. Operating profits relative to the capital stock remained basically stable for medium-sized firms and decreased slightly for large firms. Net profits relative to capital decreased marginally for medium-sized firms and increased for large firms.[9]

If we divide the sample according to firms' initial value added, the picture is different for small firms; now their profit rates increase. It remains true, however, that whatever the partition criterion or the measure of profitability is, large and medium-sized firms were the most profitable in the post liberalization period.

Cutting the sample by age adds some interesting information. As Table 1 shows, older firms tended to be the most profitable, and they increased or maintained their profit rates after 1986. Younger firms fared less well, and their profit rates fell.

Perhaps one reason that younger and smaller (according to the size of the capital stock) firms suffered after 1986 is their market orientation. Smaller and younger firms are basically oriented to the domestic market. If we divide the sample according to whether a firm had exported part of its production for at least one year, we can see that exporting firms not only had a higher rate of return, but also were performing better after liberalization than were domestic market firms. While P/K increased for exporting firms, it fell for firms oriented to the domestic market. S/K decreased for both groups, but relatively more for domestically oriented firms.

In the previous section we described how private aggregate investment decreased sharply after 1983. Our sample is picking up the years of recovery after the crisis. At an aggregate level, firms increased the investment rate, I/K, from an average of 19.2 percent in the 1984-1985 period to 21.4 percent in 1986-1988. If the sample is divided according to the size of the capital stock, we can see that smaller firms seemed more dynamic in that they had higher investment rates; however, micro and small firms, especially the former, reduced investment rates significantly after 1986, as Table 1 shows. However, the classification of firms according to the size of value added

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[7]See the footnotes to table 2A in the appendix for a precise definition of size, age, and market orientation.

[8]Note that the quality of data for micro firms is probably not as good as for the other firms. Moreover, the number of micro firms in our sample is small.

[9]Micro and small firms appear to be somewhat more profitable un the first period, relative to larger firms. This may be an artifact caused by the use of capital stock to split the sample by size. In the second period, however, medium and large firms appear as more profitable.

Table 1
PROFITABILITY, INVESTMENT, AND CAPITAL INTENSITY
(Summary statistics)

		Period	V/K	I/K	EL/K	S/K	P/K
All		84-85	1.042	0.192	1.255	0.372	0.139
		86-88	1.054	0.214	1.384	0.343	0.146
Size	Micro	84-85	2.340	0.616	5.661	0.392	0.232
by		86-88	2.100	0.347	4.976	0.316	0.144
capital	Small	84-85	1.755	0.331	3.159	0.414	0.175
stock		86-88	1.326	0.263	2.757	0.243	0.076
	Medium	84-85	1.197	0.233	1.825	0.387	0.170
		86-88	1.236	0.232	1.976	0.401	0.165
	Large	84-85	0.983	0.179	1.069	0.368	0.130
		86-88	0.991	0.207	1.167	0.331	0.144
Size	Micro	84-85	0.325	0.185	0.555	0.005	-0.014
by		86-88	0.306	0.182	0.340	0.104	-0.005
value	Small	84-85	0.662	0.202	1.125	0.109	0.004
added		86-88	0.840	0.201	1.398	0.170	0.070
	Medium	84-85	0.872	0.220	1.329	0.257	0.076
		86-88	0.830	0.219	1.397	0.266	0.081
	Large	84-85	1.167	0.183	1.288	0.449	0.177
		86-88	1.240	0.219	1.499	0.429	0.194
Age	Youngest	84-85	0.890	0.220	1.254	0.278	0.067
		86-88	0.792	0.242	1.253	0.220	0.025
	Young	84-85	0.877	0.201	1.311	0.264	0.086
		86-88	0.789	0.218	1.302	0.201	0.064
	Old	84-85	0.753	0.174	0.899	0.287	0.067
		86-88	0.791	0.198	1.003	0.294	0.103
	Oldest	84-85	1.307	0.199	1.497	0.472	0.213
		86-88	1.403	0.219	1.734	0.454	0.232
Market	Domestic	84-85	1.007	0.199	1.355	0.351	0.130
		86-88	0.968	0.218	1.421	0.322	0.122
	Export	84-85	1.074	0.183	1.124	0.400	0.149
		86-88	1.181	0.206	1.327	0.375	0.183

Notation: K=capital stock (fixed assets, except land) at replacement value; I=gross investment; V=value added; EL=efficiency units of labor (total wage bill divided by wage index in manufacturing); S= operating profits (before tax and interest payments, net of depreciation); P=net profits (after tax and interest payments, net of depreciation).

suggests that there were no major changes in the investment activity of smaller firms. The investment by larger firms increased in the post liberalization period. No significant changes were observed for medium-sized firms.

The investment rates for different age groups show an increase after 1986 for all categories. It is interesting to note that the youngest firms are the ones that had the highest investment rates in both periods. Finally, if the sample is divided by markets, firms oriented to the domestic market as well as exporting firms increased their investment rates.

Table 1 presents two indicators of the capital intensity of production, the value added to capital ratio, V/K, and EL/K, where EL denotes labor measured in efficiency units.[10] Both suggest that there was some decrease on average in the level of capital intensity, particularly for medium-sized and large firms. The increase in the cost of borrowing is one explanation for this trend. There is some evidence that small and micro firms may have become more capital intensive, but the evidence is more mixed depending upon the indicator of capital intensity and the criterion used for size. The classification according to age suggests that the decrease in capital intensity was particularly true for the older firms (which are also more likely to be larger).

III.2. FIRMS' FINANCIAL STRUCTURE

Perhaps the most dramatic changes during this period occurred in the financial structure of the firms. As described above, until 1985 interest rates were fixed administratively at a low level, and the real cost of credit was negative. Moreover, subsidized credit directed to specific groups of companies (small) or activities (exports) played a very important role. Small industry, for example, had access to special subsidized credit lines like FOPINAR (Fund for Small Industry and Handicraft), which are backed by refinancing by the Corporacion Financiera Nacional, and to Fondos Financieros, which was supported by rediscount lines at the Central Bank. Exporting firms had access to cheap credit through FOPEX (Fund for Export Promotion). FOPINAR was judged to be a well-administered program with high rates of collection.[11] Since part of the credit given to micro and small industries was at subsidized rates, the average nominal cost of debt, in other words, total interest payments divided by the stock of debt (INT/BT), was 7.5 percent and 9 percent, respectively, while medium-sized and large firms were paying 10.9 percent and 15.4 percent, respectively (see Table 2). It is generally thought that, in financially repressed

[10]Industry specific wage indices for unskilled workers have been used to calculate labor in efficiency units. See Griliches and Ringstad (1971).

[11]See World Development Report (1989).

economies, the cost of debt is higher for companies, usually small and young, that do not have access to the formal credit markets. However, the existence of subsidized credit to these groups may explain why the overall average cost of debt was lower.[12] Ideally, one should distinguish between firms within a group that had preferential credit and those that did not, but we do not have this information.

The introduction of market-determined interest rates caused an immediate increase in nominal rates. Manufacturing companies' average nominal cost of debt (INT/BT) increased after 1985. This is true for most categories of firms. If companies are divided by their capital stock, the greatest increase was for micro and small firms, for which the cost of debt went from 2.8 percent to 9.3 percent and from 7.5 percent to 10.6 percent, respectively. The same pattern is observed if value added is used to divide the sample. The increase is also very significant for the youngest companies, which experienced an increase from 10.9 percent to 14.4 percent. Note that the dispersion in the average cost of debt tends to become smaller after 1986.[13] However, larger and older firms in general still experienced a higher cost.[14]

As we can see from Table 2, up to 1985 the degree of leverage, defined as the stock of debt divided by the stock of capital (BT/K), was higher for firms that were targets of directed and subsidized credit from the Government, if we divide the sample according to the size of the capital stock. Note that the value of the capital stock we have used in separating small from medium firms is the one below which firms had access to FOPINAR. During 1984-1985 small companies had an average leverage ratio of 1.403, significantly higher than medium and large firms for which it equaled 0.927 and 0.880, respectively, as we can see in Table 2. Similarly, exporting firms were more leveraged than those that sold only to the domestic market. If age is used for classifying firms, then the youngest firms were the ones with the higher degree of leverage.

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[12] There can be an additional accounting problem, since there are firms that do not register financial costs of debt trade credit as part of financial costs, but as part of the costs of materials. In that sense, numbers obtained for the average cost of credit should be interpreted with care. If inflation gains are included, then the average cost of debt becomes negative, but the ranking of firms according to the cost of debt obviously remains the same.

[13] See Cho (1986) on the reduction in the dispersion of the cost of debt across industries in Korea, following financial liberalization.

[14] This might be an accounting artifact since some firms do not register some financial costs (for instance, the implicit interest payments on trade credit) as interest expenses.

Table 2
FINANCIAL STRUCTURE
(summary statistics)

		Period	BT/K	BST/K	BLT/K	LA/K	TCN/K	INT/BT
All		84-85	0.899	0.563	0.262	0.173	-0.074	0.139
		86-88	0.648	0.407	0.231	0.210	0.021	0.146
Size	Micro	84-85	0.905	0.522	0.060	0.221	-0.078	0.028
by		86-88	0.988	0.606	0.086	0.244	0.333	0.092
capital	Small	84-85	1.403	0.905	0.159	0.210	0.156	0.075
stock		86-88	0.883	0.482	0.122	0.269	0.290	0.106
	Medium	84-85	0.927	0.616	0.158	0.202	-0.061	0.116
		86-88	0.718	0.478	0.197	0.215	0.014	0.132
	Large	84-85	0.880	0.542	0.290	0.163	-0.083	0.147
		86-88	0.621	0.386	0.239	0.209	0.012	0.152
Size	Micro	84-85	0.515	0.452	0.047	0.054	0.007	0.075
by		86-88	0.446	0.162	0.078	0.037	0.074	0.157
value	Small	84-85	0.669	0.363	0.144	0.115	0.120	0.090
added		86-88	0.569	0.235	0.132	0.111	0.113	0.097
	Medium	84-85	1.007	0.646	0.184	0.146	-0.068	0.109
		86-88	0.675	0.407	0.206	0.141	0.014	0.120
	Large	84-85	0.901	0.552	0.309	0.193	-0.090	0.154
		86-88	0.663	0.444	0.232	0.263	0.013	0.158
Age	Youngest	84-85	1.030	0.602	0.271	0.185	0.052	0.109
		86-88	0.868	0.442	0.263	0.128	0.082	0.144
	Young	84-85	0.857	0.540	0.183	0.099	-0.062	0.120
		86-88	0.630	0.346	0.229	0.111	0.024	0.114
	Old	84-85	0.989	0.602	0.293	0.157	-0.064	0.136
		86-88	0.642	0.404	0.245	0.192	0.020	0.147
	Oldest	84-85	0.825	0.535	0.257	0.200	-0.102	0.151
		86-88	0.614	0.424	0.192	0.276	0.007	0.155
Market	Domestic	84-85	0.835	0.540	0.204	0.153	-0.029	0.138
		86-88	0.655	0.412	0.202	0.195	0.045	0.142
	Export	84-85	0.981	0.592	0.338	0.198	-0.133	0.139
		86-88	0.640	0.402	0.247	0.236	-0.016	0.152

Notation: K=capital stock (fixed assets, except land) at replacement value; BT=total debt; BST=total short term debt; BLT=total long term debt; TCN=net trade credit (credit from suppliers minus credit to clients); LA= stock of liquid assets; INT= interest paid.

The main liability of manufacturing firms was short term debt (BST); small and medium firms-sized had between three and five times more short term than long

term debt (BLT). Large firms had only twice as much.[15] Net commercial or trade credit, defined as trade credit borrowed minus trade credit given, was not significant during the 1984-1985 period except for small firms which were net debtors. Medium-sized and large firms were net creditors.

The situation changed considerably after financial liberalization. There was an overall process of adjustment of the financial structure that led to a reduction of leverage. This adjustment was particularly severe for small firms which reduced their leverage from 1.403 to 0.883 in the period 1986-1988. Medium-sized and large firms also substantially decreased their degree of leverage. If value added is used in defining size categories, we observe the same generalized reduction in leverage, but medium-sized firms are the most highly leveraged in the pre liberalization period, and the ones with the larger adjustment in the post liberalization period.

Firms of different ages -- but particularly the youngest ones - also showed significant efforts to reduce their degree of leverage. It is interesting to note that in the latter period the degree of leverage of different aged firms tends to converge, although the youngest firms were still the most highly leveraged. If the sample is divided according to markets, then both domestically oriented and exporting firms reduced their degree of leverage, the latter more than the former.

Reduction of short term credit accounted for most of the reduction in the degree of leverage. Short term debt is basically credit from banks and financial companies, which, as seen previously, suffered a significant overall reduction during the 1980s. Nevertheless, short term credit was still the main liability for manufacturing firms, as we can see in Table 2. Long term credit fell relative to the capital stock for large and small companies; it rose for medium-sized companies. Micro firms (which had the smallest long term to capital ratio), increased it slightly after 1986. If we divide the sample by age, older firms reduced their stock of long term debt relative to capital. This ratio increased for young firms and did not change for the youngest.

A very important change in this period was the increase in net trade credit (TCN/K). For most groups across different classifications, an increase in the net trade credit to capital ratio accompanied the fall in their leverage ratio. The manufacturing sector as a whole went from a net creditor position to a net debtor position. As we can see in Table 2, this trend was particularly important for micro and small firms which

[15]Total debt is composed by short term debt, long term debt and other liabilities. Among the latter, credit from the owner is particularly important for small firms, which in general are family owned and managed.

increased the use of trade credit as a proportion of their capital stock from 0.078 to 0.333 and from 0.156 to 0.29, respectively. Medium-sized and large firms, which had been net suppliers of trade credit, became net users. If we divide by age, all but the youngest companies (which increased their debt) also went from a creditor to a debtor position.

This phenomenon has been observed in other developing countries after financial liberalization. It is worth noting that, even if some administrative and interest rate controls are removed, firms may still encounter restrictions in their access to external funding because of capital market imperfections caused by informational asymmetries. This explains why, after directed credit was eliminated, small firms had to rely on suppliers' credit, for whom informational asymmetries may be less severe. Moreover, the short term nature of trade credits allows the provider to use nonrenewal to continuously monitor and discipline the borrower, if necessary.

Finally, Table 2 suggest that there was an overall movement toward improving the liquidity position of the firms. Liquid assets over capital stock (LA/K) increased for most categories of firms in the manufacturing sector. The greatest improvements were achieved by the largest and by the oldest firms. Micro firms are the exception. The overall trend can be explained by the liberalization of interest rates, which acted as an incentive for financial investment, leading to an increase in the stock of liquid assets held by companies.[16]

IV.1. CREDIT ALLOCATION

Was there any significant reallocation of the available credit after liberalization? Which firms benefited and which suffered? Table 3 shows the change in the share of new debt out of the total going to each type of firm, before and after liberalization. Our data set suggests that indeed financial resources were redistributed from small and medium-sized firms to large firms. If we divide the sample by capital stock, the share of new debt going to the latter increased from an average of 71.3 percent of total new debt in the 1984-1985 to 73.4 percent in 1986-1988, while the share of small firms declined from 4.1 percent to 3.4 percent, and for medium-sized firms from 24.3 percent to 22.8 percent. The share going to micro firms remained basically constant. This pattern is even sharper if we divide our sample according to

[16]Also minimum balance requirement by banks have become more important after 1986, since directed credit was reduced and banks had to rely mainly on funds collected from the public. On the issue of liquid asset accumulation during financial liberalization, see also Tybout (1986).

value added. Large firms increased their share from 57.3% percent to 67.1 percent, while medium-sized firms reduced it from 32.4 percent to 24 percent, small firms from 3.6 percent to 2.9 percent, and micro firms from 6.6 percent to 5.9% percent.

Table 3
DISTRIBUTION OF DEBT
(Summary statistics)

		Period	SRV	SRI	SRΔBT	SRΔBT/ SRV
Size	Micro	84-85	0.001	0.002	0.003	2.877
by		86-88	0.004	0.003	0.004	1.036
capital	Small	84-85	0.033	0.035	0.041	1.214
stock		86-88	0.034	0.035	0.034	0.979
	Medium	84-85	0.211	0.227	0.243	1.150
		86-88	0.234	0.221	0.228	0.974
	Large	84-85	0.754	0.737	0.713	0.946
		86-88	0.728	0.741	0.734	1.009
Size	Micro	84-85	0.017	0.050	0.066	3.829
by		86-88	0.018	0.058	0.059	3.267
value	Small	84-85	0.017	0.029	0.036	2.093
added		86-88	0.029	0.035	0.029	0.999
	Medium	84-85	0.191	0.264	0.324	1.697
		86-88	0.184	0.241	0.240	1.303
	Large	84-85	0.774	0.658	0.573	0.740
		86-88	0.768	0.666	0.671	0.874
Age	Youngest	84-85	0.058	0.080	0.068	1.168
		86-88	0.072	0.109	0.070	0.983
	Young	84-85	0.090	0.114	0.151	1.671
		86-88	0.103	0.141	0.112	1.096
	Old	84-85	0.253	0.310	0.447	1.765
		86-88	0.251	0.305	0.328	1.307
	Oldest	84-85	0.599	0.495	0.335	0.560
		86-88	0.575	0.445	0.489	0.851
Market	Domestic	84-85	0.537	0.588	0.451	0.840
		86-88	0.549	0.615	0.708	1.288
	Export	84-85	0.463	0.412	0.549	1.185
		86-88	0.451	0.385	0.292	0.649

Notation: SRV=share of value added out of total value added; SRI=share of investment out of total investment; SRΔBT=share of new debt out of total new debt; SRΔBT/SRV= share of new debt divided by the share of value added.

It is important to highlight the concentration of credit flows. Large firms represent around 10 percent of the firms, and received around 70 percent of the new credit. This phenomenon reflects concentration in production as well, since large firms also account for approximately 70 percent of sales and valued added. In fact, the last column of Table 4 contains the ratio between the share of new debt received and the share of value added. Note that micro firms, even though they had an insignificant amount of new debt relative to the total, had almost three times as much as their contribution to value added. Small and medium-sized firms also had more new debt relative to their value added. Only large firms had less new debt compared to their share in value added. After liberalization, firms of all types except large ones saw their share of new debt relative to their share of valued added decrease.

If we divide the sample by age, we see a large increase in the share of new debt going to the oldest firms. In contrast, young and old firms decreased their respective shares. The youngest firms basically experienced no change. All firms except the oldest ones experienced a decline in their share of new debt relative to their share of value added.

The reduction of new debt was very significant for export-oriented firms. The share of new debt of exporting firms to total new debt fell from 54.9 percent in 1984-1985 to 29.2 percent in 1986-1988. Firms that sold only to the domestic market increased from 45.1 percent to 70.8 percent. As we explained before, this might be a result of the reduction of important directed credit lines for exports in 1986. Because of this reduction, exporting firms received much less new credit relative to their share in value added after liberalization.

In the final analysis, it appears that liberalization helped to direct credit toward larger and older firms. Moving from markets with administrative controls on quantities and interest rates to less regulated markets does not mean moving to a world of perfect capital markets. Moreover, since informational asymmetries remain, credit flows to firms that are less likely to suffer from those asymmetries, like older and larger firms.[17]

IV.2. EFFICIENCY AND THE ALLOCATION OF CREDIT

The foregoing analysis suggests that financial liberalization helped to direct credit toward older and larger firms. Large firms (together with medium-sized ones)

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[17]On these issues see Stiglitz and Weiss (1981) and Gertler and Rose (1991).

also exhibit higher rates of profit after liberalization. It would be useful to investigate in more depth how the allocation of credit is associated with firms' characteristics. The question we address in this section is whether financial liberalization succeeded in directing resources to more efficient firms.[18] We also investigate the reallocation of credit across different industries.

One could adopt various concept of efficiency. We will focus here on technical efficiency, which measures how close a firm is to the production possibility frontier for a given quantity of capital and labor.[19] The econometric estimation of technical efficiency with a stochastic frontier, when only cross section data are available, has been analyzed by Aigner, Lovell and Schmidt (1977). Schmidt and Sickles (1984) discuss the estimation procedures that are appropriate when panel data are available.[20] They show that technical efficiency can be estimated using pooled cross section-time series observations without making restrictive assumptions about the distribution of the error term, as in the case of a single cross section. More precisely, consider the following model:

$$(1) \qquad y_{it} = \alpha + \beta' x_{it} + \varepsilon_{it} - \upsilon_i$$

where $i=1,\ldots N$ firms, and $t=1,\ldots T$ periods, y_{it} refers to output of firm i in period t, x_{it} is a vector of inputs used by firm i in period t, ε_{it} is a random shock, υ_i captures firm specific and time invariant technical inefficiency of plant i, and we assume that $\upsilon_i \geq 0$. We can rewrite the model defining $\alpha_i = \alpha - \upsilon_i$ as:

$$(2) \qquad y_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it}$$

Estimates of α_i can be used directly as a measure of efficiency. Alternatively, we can take advantage of the fact that $\upsilon_i \geq 0$ to normalize the estimates. Provided that N is large, we can assume that for the most efficient firm in the sample

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[18]On the effect of efficiency on the capital structure of Colombian firms, see Atiyas (1991). On the general issue of financial repression and firms' capital structure, see also Faini , Galli and Giannini (1991) on the case of Southern Italy.

[19]See Farrel (1957).

[20]See also Schmidt (1985). For applications to data for less developed countries, see Tybout, De Melo, and Corbo (1990), Tybout and Westbrook (1990), Liu (1991).

υ_i equals zero. Then, defining $\hat{\alpha} = \max (\hat{\alpha_i})$, each firm efficiency index can be calculated as $- \hat{\upsilon_i} = -(\hat{\alpha} - \hat{\alpha_i})$.

If we assume that α_i is fixed, we can obtain consistent estimates of the parameters (when the x's are independent of the ε_{it}) using the "within" estimator. Having estimated β, an estimate of α_i can then be recovered by averaging the residuals for each firm over time. Consistency of the estimate for α_i requires T to go to infinity. Alternatively, if we assume that the α_i are random, we can recover consistent estimates for β using a feasible GLS estimator, provided the x's are not correlated with α_i. Again, a consistent estimate of the α_i (for T going to infinity) can be obtained by averaging the residuals for each firm over time. Finally, if we assume that the x's are not independent of ε_{it}, we can obtain consistent estimates of β by using a GMM estimator applied to the model in differences (see Arellano and Bond (1991), (1988)). For α_i, we proceed as in the previous two cases.

We have used all three alternative estimation methods, and we have also included time dummies to control for technical progress or other macro shocks like the earthquake registered in Ecuador in 1987. In obtaining econometric estimates of technical efficiency we have used the balanced panel of 420 firms for which observations exist for all the years. We concentrate on the balanced sample because the reliability of our measure of technical efficiency depends crucially upon the length of the time dimension of the panel. The most general equation we have estimated is a translog valued added production function with adjustment costs for capital:

$$(3)\ v_{it} = \alpha_i + \beta_1 l1_{it} + \beta_2 l2_{it} + \beta_3 k_{it} + \gamma_1 (l1_{it}^2) + \gamma_2 (l2_{it})^2 + \gamma_3 (k_{it})^2 + \gamma_4 (l1_{it}\, l2_{it}) + \gamma_5 (l1_{it}\, k_{it}) + \gamma_6 (l2_{it}\, k_{it}) + \gamma_7 i_{it} + \varepsilon_{it}$$

where v is the log of real value added, l1 the log of blue collar labor measured in efficiency units,[21] l2 is the log of white collar labor measured in efficiency units, k is the log of the real capital stock (machinery, plant, and equipments) measured at its replacement value, and i denotes investment. All variables are measured at 1975 prices. The coefficients will be allowed to vary across industries in some of the specifications.

Note that if $\gamma_7 = 0$, then adjustment cost may be ignored, and the production function is the usual translog function. If γ_1 to γ_7 are all equal to zero, then equation (3) reduces

[21]Labor in efficiency units was calculated by dividing the nominal wage bill by the wage index for manufacturing.

to a simple Cobb-Douglas function. An interesting special case we will investigate is the one in which constant returns to scale are imposed for the Cobb-Douglas specification. One justification for imposing constant returns to scale is that, if the capital stock is measured with error, the fixed effect and the GLS estimate of the degree of returns to scale in the unrestricted model will be biased downward (Griliches and Hausman (1986)). In this case, we will find spurious positive association between efficiency and size. Most of our estimated models do indeed suggest decreasing returns to scale, including the ones estimated by GMM on differenced data. All the results are reported in Appendix B. Table 4 presents the correlation between the measures of efficiency based on different specification of the production function and different estimation methods. As one can see, most of them are highly correlated ,and hence it should be no surprise that they yield similar results when they are used to investigate the determinants of credit allocation. For this reason, we present the results only for a small subset of our efficiency measures.

Table 4
CORRELATION BETWEEN DIFFERENT MEASURES OF EFFICIENCY

	TLAC	TLACO	IV	REFF	TLIND	CD	CDIND	TLNAC	CRS	CRS0	CRS1
TLAC	1.000	0.946	0.940	0.713	0.928	0.991	0.919	1.000	0.778	0.522	0.758
TLAC0		1.000	0.927	0.551	0.884	0.951	0.895	0.946	0.651	0.545	0.577
IV			1.000	0.505	0.879	0.930	0.870	0.939	0.618	0.393	0.591
REFF				1.000	0.667	0.717	0.662	0.716	0.728	0.515	0.692
TLIND					1.000	0.919	0.909	0.928	0.957	0.733	0.936
CD						1.000	0.929	0.992	0.807	0.575	0.778
CDIND							1.000	0.920	0.753	0.565	0.714
TLNAC								1.000	0.781	0.526	0.761
CRS									1.000	0.807	0.953
CRS0										1.000	0.639
CRS1											1.000

Note: the indices of efficiency are derived from different estimation methods and specifications of the value added production function, as explained below:
TLAC= translog function, adjustment costs, fixed effect; TLAC0= translog function, adjustment costs, fixed effect, 1984-1985 period; IV= translog function, adjustment costs, instrumental variables; REFF= translog function, adjustment costs, random effect; TLIND= translog function, adjustment costs, fixed effect, by industry; CD= Cobb-Douglas function, adjustment costs, fixed effect; CDIND= Cobb-Douglas function, adjustment costs, fixed effect, by industry; TLNAC= translog function, no adjustment costs, fixed effect; CRS= Cobb Douglas-function, no adjustment costs, fixed effect, imposing constant returns to scale; CRS0= Cobb-Douglas function, no adjustment costs, fixed effect, imposing constant returns to scale, period 1984-1985; CRS1= Cobb-Douglas function, no adjustment costs, fixed effect, imposing constant returns to scale, period 1986-1988.

In Table 5. we investigate the correlation between efficiency and firms' characteristics (size, age, market orientation). For illustrative purpose we present the results for the measures of efficiency obtained, using the within estimator, from the translog production function, with adjustment costs estimated separately for each industry (TLIND), or for manufacturing as a whole (TLAC). We also present the results for the Cobb-Douglas production function estimated imposing the same slope coefficients for all industries, constant returns to scale, and no adjustment costs (CDCRS). In all cases we measure the efficiency of individual firms relative to the most efficient firm in each industry.[22] The results indicate that, ceteris paribus, efficiency increases both with size and age. Moreover, exporting firms appear to be more efficient than nonexporting firms. This can be interpreted as evidence that larger older and export oriented firms may have an easier accesss to the best practice technology. Note that efficiency increases with size also for the Cobb-Douglas specification with constant returns to scale, although the size effect is now generally smaller and less significant.

[22]This is the correct procedure when α in equation (1) varies across industries.

Table 5
EFFICIENCY AND FIRMS' CHARACTERISTICS

Dependent variable	TLAC	TLIND	CDCRS
Intercept	-3.421	-3.726	-2.882
	-(20.39)	-(19.82)	-(19.07)
S2	0.006	-0.030	0.078
	(0.03)	(0.16)	(0.53)
S3	0.510	0.452	0.233
	(3.11)	(2.46)	(1.58)
S4	1.271	1.233	0.369
	(7.53)	(6.51)	(2.43)
A2	0.070	0.001	0.069
	(1.56)	(0.02)	(1.71)
A3	0.240	0.210	0.139
	(4.90)	(3.83)	(3.15)
A4	0.310	0.255	0.140
	(6.08)	(4.45)	(3.03)
EXPS	0.201	0.245	0.137
	(4.83)	(5.18)	(3.61)
R2	0.597	0.574	0.195

where: S2, S3, and S4 are size dummies for small, medium, and large firm; A2, A3, and A4 are age dummies for young, old and oldest firms; EXPS is the export dummy; industry dummies,denoted in the following tables by SEC2 through SEC9, have been included in all the regressions; t statistics in parentheses.

Is firm efficiency one of the factors determining the allocation of credit? According to the financial development literature, firms that have access to credit markets in financially repressed economies are not necessarily the best and most efficient ones. When there is heavy administrative interference with the financial system, large and politically well connected firms may be the ones that benefit from directed credit. Moreover, the right incentives may not exists for bank in screening their borrowers and in monitoring loans. It is believed that the removal of administrative controls will help in directing credit to more efficient firms. Table 6 contains the simple correlation coefficients between the three measures of technical efficiency discussed above, the investment rate, the profit rate, the growth rate of sales, and the new debt to capital ratio. The highest correlation is the one between efficiency and profitability (between 0.299 and 0.451). Obviously, more efficient firms will tend to be more profitable. Similarly, there is a significant correlation, although a smaller one, between efficiency and real growth rates, suggesting that more efficient firms are also more dynamic. It is very interesting to note that the correlation between efficiency,

on the one hand, and new debt and investment, on the other, is not significant in the pre-liberalization period. The correlation with both variables is, however, positive and significant in the post liberalization period.

Table 6
CORRELATION BETWEEN EFFICIENCY AND SELECTED INDICATORS

	TLAC	TLIND	CDCRS	TLAC	TLIND	CDCRS	TLAC	TLIND	CDCRS
	84-88			84-85			86-88		
P/K	0.306	0.304	0.445	0.291	0.300	0.442	0.324	0.311	0.451
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
GYREAL	0.124	0.104	0.154	0.105	0.088	0.174	0.168	0.141	0.135
	(0.00)	(0.00)	(0.00)	(0.03)	(0.07)	(0.00)	(0.00)	(0.00)	(0.01)
I/K	0.019	0.028	0.110	-0.041	-0.033	0.059	0.088	0.097	0.170
	(0.58)	(0.42)	(0.00)	(0.40)	(0.50)	(0.23)	(0.07)	(0.05)	(0.00)
ΔBT/K	0.054	0.055	0.110	0.005	-0.005	0.069	0.114	0.128	0.160
	(0.12)	(0.11)	(0.00)	(0.92)	(0.92)	(0.16)	(0.02)	(0.01)	(0.00)

where:
P/K= after tax profit over capital stock; GYREAL = growth rate of real sales; I/K=gross investment over capital stock; ΔBT/K = new debt over capital stock. Marginal probability values in parenthesis.

These simple correlations suggest that there is some prima facie evidence that financial liberalization has had a beneficial effect on the allocation of credit. Additional evidence can be gathered by analyzing the determinants of the change in the average amount of new debt obtained by each firms in the post liberalization period, relative to the pre liberalization period. The dependent variable in the regression is $(\Delta B/K)_{post} - (\Delta B/K)_{pre}$, where $(\Delta B/K)$ is the average change in debt, relative to the capital stock, for each individual firm. In addition to efficiency, we include as explanatory variables size, age, industry, and export dummies. The other regressors are a set of firm's characteristics in the pre-liberalization period, that are meant to capture the severity of agency problems they face. The additional explanatory variables are: the average real growth rate in real sales (LYREAL), the average degree of leverage (LBT/K), the average liquid assets to capital ratio (LLA/K), and the average cash flow to capital ratio (LCF/K). The results are reported in Table 7.

Table 7
CHANGE IN CREDIT ALLOCATION

Dependent variable	$(\Delta B/K)_{post} - (\Delta B/K)_{pre}$		
INTERCEPT	0.370	0.184	0.558
	(0.88)	(0.45)	(1.33)
S2	0.215	0.231	0.182
	(0.73)	(0.78)	(0.62)
S3	0.227	0.277	0.224
	(0.75)	(0.93)	(0.75)
S4	0.213	0.305	0.282
	(0.65)	(0.95)	(0.91)
A2	-0.036	-0.029	-0.039
	-(0.45)	-(0.36)	-(0.49)
A3	-0.063	-0.054	-0.052
	-(0.70)	-(0.60)	-(0.59)
A4	-0.169	-0.156	-0.146
	-(1.79)	-(1.66)	-(1.56)
SEC2	-0.099	-0.087	-0.200
	-(0.85)	-(0.68)	-(1.53)
SEC3	-0.321	-0.221	-0.320
	-(1.67)	-(1.25)	-(1.90)
SEC4	-0.010	0.026	-0.043
	-(0.07)	(0.17)	-(0.32)
SEC5	0.227	0.282	0.072
	(1.89)	(2.47)	(0.48)
SEC6	-0.008	0.081	-0.300
	-(0.05)	(0.57)	(1.36)
SEC7	0.234	0.297	0.067
	(1.19)	(1.56)	(0.31)
SEC8	0.124	0.158	-0.090
	(0.99)	(1.20)	-(0.52)
SEC9	-0.329	-0.220	-0.486
	-(1.24)	-(0.85)	-(1.77)
EXPS	-0.063	-0.058	-0.061
	-(0.82)	-(0.75)	-(0.81)
LYREAL	-0.294	-0.282	-0.319
	-(2.91)	-(2.79)	-(3.13)
LBTK	-0.222	-0.221	-0.222
	-(7.87)	-(7.81)	-(7.89)
LLAK	0.182	0.180	0.175
	(3.18)	(3.13)	(3.07)
LCFK	-0.111	-0.089	-0.136
	-(1.95)	-(1.63)	-(2.35)
TLAC	0.138		
	(1.83)		
TLIND		0.083	
		(1.30)	
CDCRS			0.217
			(2.49)
R2	0.223	0.219	0.228

The debt to capital ratio and the liquid assets to capital ratio have, respectively, a negative and a positive significant effect on the change in the allocation of new debt. This evidence is consistent with the existence of some agency/financial distress cost. The basic idea is that highly leveraged firms will face greater marginal costs of debt and more difficult access to new debt. Conversely, firms with a liquid position will find easier and cheaper access to credit markets. The effect of previous growth rate and the amount of cash flow relative to capital stock is also important in determining the changes in allocation of debt. Results suggest that this effect is negative and significant for both variables. A possible explanation is that profitable and dynamic firms can more easily finance their investment projects with their own resources. The size age and export dummies are not individually or jointly significant at conventional levels.

The important result is that all three measures of efficiency have positive effects on the change in debt allocation, and the effect is significantly different from zero, in a one tailed test at the 5% significance level, for two of the three measures. Controlling for all the other factors mentioned above, credit was flowing in greater quantity to more efficient firms within each industry after liberalization. In order to show that the correlation between debt allocation and efficiency is not due to reverse causality (firms that receive credit become more efficient), we have included in Table 7 a last column of results, obtained using the efficiency measure from a constant return to scale Cobb-Douglas production estimated only on the pre-liberalization years (CDCRSO). Also in this case the coefficient of CDCRSO is significant and positive. Another potential econometric problem with the results is that our efficiency variable is a generated regressor that measures true efficiency with error. If we believe that banks themselves do not know true efficiency, but estimate it using the same methods we have used, then this is not an issue. However, if banks know true efficiency, then we have a problem of generated regressors, as described in Pagan (1984), with the added feature that in our case the measurement error does not disappear, because in estimating efficiency we have used a panel with few time periods. The result is that the estimates of the coefficients and of their standard errors in the debt allocation equation are not consistent (for N going to infinity). Fortunately, if the hypothesis to be tested is whether the coefficient on efficiency equals zero, the "asymptotic t-statistic" obtained by using OLS is valid. Hence our conclusion on the significance of efficiency in

explaining debt allocation is robust to this potential criricism. [23]

V. CONCLUSIONS

What have we learned from company panel data about the effects of financial liberalization on Ecuadorian manufacturing firms? Financial liberalization meant an increase in the cost of credit, and all firms had to readjust their financial structure. There is evidence that the reduction in the degree of leverage was more substantial for small firms. There are two main reasons that can explain this outcome. First, with financial liberalization, directed credit programs for small firms were either scaled down or eliminated. Second, even after the removal of administrative controls, capital markets are characterized by asymmetric information problems that are more severe for small and young firms. This means that these firms may still encounter difficulties in gaining access to credit from financial intermediaries. It is very suggestive in this respect that the importance of trade credit increases for all firms in the post liberal;ization period, but in particular for the smaller ones. It may be easier for suppliers to monitor firm's performance. Moreover, the short term nature of trade credit allows providers to use non renewal s a mean to discipline borrowers, if necessary. One of the criticism levelled at directed credit programs characterized by very low (often negative) interest rates is that they distorts factor prices and encourage capital intensive production techniques. Our data indeed suggest that capital intensity decreased after liberalization for medium and large firms. The effect on smaller firms is more ambiguous.

The analysis of the effect of financial liberalization on credit allocation reflects some of the points we have already made concerning the adjustment in firms' financial structure. The data show, in fact, that there was a reallocation of financial resources toward the largest and oldest firms. Large firms (together with the medium ones that see their share of debt decrease) are also those with the better profit record after liberalization. Finally, a detailed econometric investigation of credit allocation provides empirical evidence that financial liberalization has helped in directing credit to technically more efficient firms. This is a very interesting and novel result concerning the real effects of financial reforms. We are not suggesting here that technical efficiency should be used as the sole criterion in judging whether financial liberalization has been successful. One should find some comfort, however, in the fact that credit

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[23]Note that the "symptotic t- statistics for the other regressors are not correct.

allocation has benefitted those firms that have access to the best technological opportunities and/or make the best use the factors of production at their disposal.

There are obvious limitations in the analysis we have conducted here, starting with the small number of years at our disposal. Moreover, the process of financial liberalization does not occur in isolation, and its results depend upon the other demand and supply shocks that affect the economy. A clearer picture will emerge when we will have had the opportunity to observe the changes in the behavior of institutions and economic agents over a longer time period. However, we hope that this paper illustrates the usefulness of a research strategy based on firms' panel data, and, at the same time, starts shedding light on the real effects of financial liberalization.

APPENDIX A: DESCRIPTION OF THE DATA

The empirical research was based on information collected by the "Superintendecia de Companias" (SC) of Ecuador. SC is a government agency that controls corporate activities. By law, firms have to submit balance sheet and profit and losses information to SC in order to do business in Ecuador and in order to obtain credit (official loans, as well as regular credit), tax identification numbers, and so on.[24] After eliminating firms with missing, unacceptable, or inconsistent data, or firms not engaged in production activities,we obtained a sample of 853 firms with complete information available for at least three consecutive years during the period 1983-1988.[25] For 420 firms have data for the full six-year period.

The balance sheets also include, together with the standard items, information on the revaluation of assets allowed by the Government to account for inflation and exchange rate depreciation. Our capital stock measure is the revalued one and it includes plant and machinery, buildings, and others (excluding land). Investment figures can be obtained using the information on capital stock in successive periods.

The sample represents a very important share of the total manufacturing sector. Table 1A shows the weight of the sample relative to manufacturing: it covers almost half of the sales and value added in manufacturing, and around one-third of manufactured exports.[26]

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[24]Younger (1990) has worked with the same source of information, but has aggregated the data at a four digit level.

[25]We have also restricted the sample to those firms that have a growth rate of sales between -76% and 500%.

[26]Export figures refer to sales in foreign markets made directly by the company. Note that some companies may export indirectly through trading companies, though these sales would not appear as exports. That is why the quantitative importance of exports in this survey relative to total manufactured exports is less than the share of sales or value added.

Table 1A
WEIGHT OF THE SAMPLE RELATIVE TO MANUFACTURING SECTOR
(fifures in millions of 1975 sucres)

Year	Net sales (Y)	Value added (V)	Exports (X)	Y/total output	V/total value added	X/total exports
1983	32317.15	11849.05	2214.19	0.4079	0.406	0.3548
1984	35755.61	12026.1?	2461.09	0.4366	0.4199	0.3371
1985	38525.45	11707.77	2865.12	0.453	0.4078	0.3652
1986	45999.62	14236.39	4826.98	0.5209	0.5041	0.5264
1987	44983.43	13694.49	3560.62	0.4973	0.4767	0.2921
1988	48108.76	13819.49	3577.48	0.5084	0.4704	0.2712
Average				0.4707	0.4475	0.3578

Note: Y, V, and X are the figures for the firms in the panel. Total output, total value added, and total exports are aggregates from the National Accounts. Source: Banco Central del Ecuador (1990), Cuentas Nacionales #13.

The sample includes a wide range of firms of different sizes, ages, and sectors. Most of the companies are classified as small or medium sized(using the value of plant and machinery in the first year as the size criterion).[27] There is a limited number of micro firms for which (as a group) the quality of data is not very good. Large firms are also few in number, but very important in terms of their share of total production.

[27]It was not possible to use employment to determine the size of the firm, since no data on labor is available. Instead, we used the value of plant and machinery as the criterion for size. Companies defined as small, according to the size of the capital stock we used, were eligible to receive special credit, tax and other subsidies under the "Ley de Fomento a la Pequeña Industria y Artesanía" (Promotion Law for Small Industry and Handicraft).

Table 2A
NUMBER OF FIRMS IN THE SAMPLE
(By different categcries)

Category	Frequency	Percent	Cum. Freq.	Cum. Per.
By size: (capital stock)				
Micro	42	4.9	42	4.9
Small	284	33.3	326	38.2
Medium	387	45.4	713	83.6
Large	140	16.4	853	100.0
By size: (value added)				
Micro	31	3.6	31	3.67 6
Small	291	34.1	322	37.7
Medium	395	46.3	717	84.1
Large	136	15.9	853	100.0
By age:				
Micro	217	25.4	217	25.4
Small	307	36.0	524	61.4
Medium	167	19.6	691	81.0
Large	162	19.0	853	100.0
By markets:				
Nonexport	721	84.5	721	84.5
Export	132	15.5	853	100.0
By sector:				
31: Food and Beverages	167	19.6	167	19.6
32: Textiles	130	15.2	297	34.8
33: Lumber	52	6.1	349	40.9
34: Paper and Printing	85	10.0	434	50.9
35: Chemicals	162	19.0	596	69.9
36: Metallic minerals	50	5.9	646	75.7
37: Nonmetallic minerals	23	2.7	669	78.4
38: Machinery	168	19.7	837	98.1
39: Others	16	1.9	853	100.0

Notes: Definition of size by capital stock: micro: US$ 2000 < K; Small: US$ 2000 < K < US$ 40000; Medium: US$ 40000 < K < US$ 600000; Large: K > US$ 600000. Definition of size by value added: micro: US$ 2000 < V; Small: US$ 2000 < V < US$ 40000; Medium: US$ 40000 < V < US$ 600000; Large: V > US$ 600000. K : machinery, plant. and equipment, other (excluding land) in 1983; V: value added in 1893; both K and V are valued at 1975 US$ dollars. Definition of age: youngest: born after 1980; young: born between 1970 and 1980; old: born between 1960 and 1970; oldest: born before 1960. Definition of export oriented: firm must have exported at least once during the period.

If we do a cross-tabulation between different categories, we find that most micro, small and medium sized firms began their activities after 1970, while the majority of large firms were born before the 1970s, as Table 3A shows. It is also true that export firms are either medium or large sized.

Table 3A

FIRMS BY SIZE, AGE, AND MARKET

Size\Age	Youngest	Young	Old	Oldest	Export	Nonexport
Micro	17	23	2	0	0	42
Small	91	129	44	20	14	270
Medium	98	137	76	76	60	327
Large	11	18	45	66	58	82

APPENDIX B: ESTIMATION OF THE EFFICIENCY INDEX

This appendix presents the econometric results for different specifications of the production function, using different estimation methods. The estimates are used to obtain the technical efficiency index used in the paper.

Table 1B
PRODUCTION FUNCTION ESTIMATES
Same slope coefficients across industries

Dependent variable	v=log of value added						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
k	0.103	0.105	0.222	0.110	0.075	0.044	0.229
	(4.58)	(4.72)	(13.38)	(5.22)	(1.88)	(0.13)	(9.47)
l1	0.346	0.346	0.416	0.374	0.285	0.396	0.504
	(14.33)	(14.31)	(20.86)	(16.86)	(9.71)	(1.28)	(26.96)
l2	0.295	0.294	0.394	0.203	0.217	0.139	0.267
	(12.74)	(12.71)	(23.15)	(12.56)	(7.61)	(0.42)	(17.40)
k2	-0.012	-0.011	0.004		-0.011	-0.077	
	-(1.64)	-(1.55)	(0.66)		-(0.97)	-(0.98)	
$l1^2$	0.035	0.035	0.049		0.019	0.034	
	(4.35)	(4.37)	(7.08)		(8.85)	(1.58)	
$l2^2$	0.019	0.019	0.035		0.012	0.007	
	(3.80)	(3.78)	(8.58)		(6.08)	(0.24)	
kl1	-0.009	-0.009	-0.011		0.002	0.008	
	-(2.24)	-(2.19)	-(2.94)		(0.30)	(0.11)	
kl2	0.006	0.006	0.002		-0.006	-0.020	
	(0.51)	(0.51)	(0.18)		-(0.82)	-(0.31)	
l1l2	-0.061	-0.060	-0.080		-0.013	-0.005	
	-(4.63)	-(4.60)	-(7.23)		-(1.59)	-(0.05)	
l^2/K	0.000		0.000	0.000	0.000	0.001	
	(0.93)		(0.11)	(0.40)	(0.57)	(0.41)	
D85	-0.061	-0.061	-0.075	-0.058			-0.072
	-(3.05)	-(3.03)	-(3.76)	-(2.84)			-(3.47)
D86	-0.041	-0.040	-0.061	-0.038			-0.056
	-(2.05)	-(1.99)	-(3.02)	-(1.84)			-(2.70)
D87	-0.117	-0.114	-0.133	-0.108			-0.127
	-(5.63)	-(5.56)	-(6.50)	-(5.19)			-(5.99)
D88	-0.206	-0.202	-0.244	-0.195	-0.006	0.029	-0.228
	-(9.47)	-(9.44)	-(11.72)	-(9.10)	-(0.20)	(0.56)	-(10.67)
ONE			0.284		-0.076	-0.104	
			(10.18)		-(4.16)	-(2.09)	
R2adj.	0.967	0.967	0.911	0.966	0.212	0.110	0.903
X1	7653.3	7652.2		7592.9	211.7	22.0	3306.6
d.f.	432	432		427	10	10	419
	(0.0000)	(0.0000)		(0.0000)	(0.0000)	(0.0150)	(0.0000)
Hausman			0.0				
d.f.			14				
			(0.6111)				
Sargan						7.9	
d.f.						6	
						(0.2412)	

Variables are defined in equation (3); small case letters denote logs; X1: chi-square tests on the equality of the firm specific constants; Haussman: chi-square test of the GLS estimator for the random effect model against the within estimator; Sargan: chi-square test of overidentifying restrictions; degrees of freedom and p-values below tests; column. (1): within estimator; (2): within, no adjustment cost; (3): GLS for random effect; (4): within, Cobb-Douglas; (5): first differences, OLS; (6): first differences, GMM; (7) : within, Cobb-Douglas, constant returns.

Table 2B
PRODUCTION FUNCTION ESTIMATES
Translog production function by sector

Dependent variable	v=log of value added								
	Sec. 31	Sec. 32	Sec. 33	Sec. 34	Sec. 35	Sec. 36	Sec. 37	Sec. 38	Sec. 39
k	0.037	0.200	0.052	0.070	0.066	0.189	-0.260	0.089	0.482
	(0.61)	(3.46)	(0.69)	(1.45)	(1.00)	(1.39)	-(1.16)	(1.79)	(2.57)
l1	0.393	0.280	0.377	0.455	0.222	0.371	0.888	0.521	0.285
	(4.76)	(6.20)	(3.59)	(4.91)	(2.85)	(3.09)	(2.81)	(9.02)	(2.77)
l2	0.257	0.319	0.215	0.315	0.300	-0.026	-0.023	0.435	0.360
	(4.29)	(5.18)	(2.71)	(4.91)	(5.09)	-(0.13)	-(0.06)	(7.78)	(2.44)
k^2	-0.005	-0.021	-0.042	-0.016	0.014	0.034	-0.042	-0.024	-0.149
	-(0.25)	-(1.25)	-(1.69)	-(0.74)	(0.58)	(0.81)	-(1.23)	-(1.33)	-(2.07)
$l1^2$	0.012	0.079	0.133	0.016	0.042	-0.196	0.115	0.021	0.192
	(0.56)	(4.92)	(2.59)	(0.48)	(1.55)	-(3.94)	(2.65)	(0.87)	(2.10)
$l2^2$	0.030	0.054	0.067	0.019	0.051	-0.081	0.227	0.043	0.347
	(3.20)	(2.22)	(1.77)	(1.06)	(2.39)	-(1.38)	(1.90)	(1.73)	(4.52)
kl1	-0.036	0.007	-0.012	-0.003	-0.004	-0.008	-0.014	-0.014	-0.062
	-(2.79)	(0.67)	-(0.97)	-(0.36)	-(0.29)	-(0.53)	-(0.47)	-(1.24)	-(0.62)
kl2	-0.001	0.033	0.096	0.058	-0.070	-0.150	0.200	-0.002	0.026
	-(0.02)	(0.95)	(1.32)	(1.89)	-(1.68)	-(1.95)	(1.75)	-(0.05)	(0.26)
l1l2	-0.018	-0.120	-0.268	-0.092	-0.044	0.388	-0.393	-0.140	-0.477
	-(0.78)	-(2.90)	-(3.51)	-(1.77)	-(1.03)	(3.58)	-(2.59)	-(3.46)	-(2.87)
i	0.001	0.000	0.000	0.000	0.001	0.000	-0.001	0.001	0.002
	(1.28)	-(0.11)	-(0.08)	-(0.17)	(1.07)	-(0.14)	-(0.48)	(1.14)	(0.22)
D85	-0.141	-0.109	0.122	0.053	-0.085	0.120	-0.004	-0.075	-0.027
	-(3.04)	-(2.39)	(1.76)	(1.13)	-(1.70)	(1.28)	-(0.04)	-(1.72)	-(0.32)
D86	-0.048	-0.050	0.163	-0.026	-0.068	0.150	-0.205	-0.051	-0.241
	-(1.03)	-(1.07)	(2.37)	-(0.55)	-(1.35)	(1.46)	-(1.74)	-(1.17)	-(2.87)
D87	0.021	-0.163	-0.048	-0.183	-0.166	0.125	-0.111	-0.177	-0.219
	(0.44)	-(3.50)	-(0.64)	-(3.73)	-(3.23)	(1.21)	-(0.82)	-(3.92)	-(2.56)
D88	-0.011	-0.203	-0.170	-0.327	-0.351	0.090	-0.415	-0.248	-0.395
	-(0.22)	-(4.15)	-(2.16)	-(6.53)	-(6.64)	(0.74)	-(2.40)	-(5.04)	-(4.21)
Nobs.	405	315	115	240	430	110	65	370	50
R2adj.	0.966	0.976	0.976	0.978	0.953	0.971	0.976	0.974	0.979

Table 3B
PRODUCTION FUNCTION ESTIMATES
Cobb-Douglas production function by sector

	Sec. 31	Sec. 32	Sec. 33	Sec. 34	Sec. 35	Sec. 36	Sec. 37	Sec. 38	Sec. 39
k	0.050	0.221	0.131	0.078	0.028	0.287	0.071	0.116	0.536
	(0.96)	(4.11)	(2.03)	(1.73)	(0.51)	(3.09)	(0.61)	(2.44)	(4.09)
l1	0.415	0.226	0.518	0.425	0.260	0.341	0.293	0.479	0.490
	(8.11)	(5.04)	(5.67)	(7.29)	(4.07)	(2.83)	(2.16)	(9.20)	(5.88)
l2	0.148	0.241	0.037	0.281	0.183	0.125	0.282	0.327	-0.252
	(5.42)	(5.46)	(0.62)	(6.91)	(4.22)	(1.25)	(2.19)	(7.77)	-(2.46)
I^2/K	0.001	0.000	-0.001	0.000	0.000	-0.001	-0.002	0.001	-0.006
	(1.20)	(0.25)	-(0.62)	-(0.19)	(0.32)	-(1.24)	-(1.23)	(0.70)	-(0.65)
D85	-0.130	-0.106	0.121	0.036	-0.097	0.137	0.029	-0.093	-0.075
	-(2.81)	-(2.24)	(1.71)	(0.78)	-(1.92)	(1.36)	(0.26)	-(2.06)	-(0.70)
D86	-0.047	-0.051	0.155	-0.043	-0.066	0.087	-0.169	-0 063	-0.202
	-(1.02)	-(1.06)	(2.17)	-(0.93)	-(1.30)	(0.80)	-(1.47)	-(59)	-(1.82)
D87	0.028	-0.147	-0.025	-0.201	-0.160	0.092	-0.031	-0.188	-0.150
	(0.59)	-(3.05)	-(0.34)	-(4.20)	-(3.12)	(0.86)	-(0.24)	-(4.09)	-(1.40)
D88	0.005	-0.167	-0.116	-0.335	-0.335	-0.023	-0.137	-0.295	-0.184
	(0.10)	-(3.35)	-(1.53)	-(7.01)	-(6.41)	-(0.21)	-(0.94)	-(6.05)	-(1.69)
Nobs.	405	315	115	240	430	110	65	370	50
R2adj.	0.966	0.975	0.972	0.978	0.952	0.966	0.973	0.972	0.961

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